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Research Article

Accelerated rehabilitation and return to sport after hip arthroscopy for femoroacetabular impingement syndrome is safe and effective

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ABSTRACT

Present recommendations in the literature advocate for a return to sport (RTS) between 5- and 10 months following hip arthroscopy for femoroacetabular impingement (FAI). We have adopted the International Society of Hip Preservation protocol with modifications for the rehabilitation of our patients. The aim of the present study was to examine the time to RTS with this rehabilitation approach after hip arthroscopy for FAI. It was hypothesized that most athletes will RTS by 5 months post-surgery without any adverse effects. Patients undergoing hip arthroscopy for FAI were prospectively followed with preoperative and postoperative Patient Reported Outcome Measures including: Modified Harris Hip Score (mHHS) and Copenhagen Hip and Groin Outcome Score (HAGOS). Preinjury sports and competition level, postoperative RTS rate, time, and level, complications, and revision surgeries were recorded. A total of 56 patients were identified for inclusion (36.6 ± 14.1 years old at date of surgery, 34 females and 22 males). There were 35 recreational athletes and 21 competitive-level athletes (10 in high-demand sports and 11 in moderate-demand sports). In all, 44 patients (79%) returned to sport at 5.3 ± 3.5 months postoperatively. Of the 12 patients who did not RTS, 5 (42%) did not return for reasons other than their hip. Neither HAGOS ($P = .458$) nor mHHS ($P = .424$) differed between athletes with RTS in ≤ 5 months (HAGOS: 80.4 ± 22.3; mHSS: 88.0 ± 17.7) versus >5 months (HAGOS: 84.6 ± 11.8; mHSS: 91.5 ± 8.7). The current study demonstrates that accelerated rehabilitation after hip arthroscopy for FAI can safely return athletes to sport within 6 months.

INTRODUCTION

Femoroacetabular impingement (FAI) is increasingly recognized as a common cause of hip and groin pain [1], impacting athletes across various competitive levels [2, 3]. When symptomatic FAI hinders athletic performance, and conservative treatments prove ineffective, surgical intervention typically involves hip arthroscopy to address chondro-labral pathology and correct underlying osseous malformations of the femur and acetabulum [4]. Arthroscopic labral repair has emerged as the gold standard treatment for FAI with labral tear [5], particularly for active patients seeking a return to their sport. Success in surgical intervention is often gauged by the athlete's ability to successfully resume their chosen sport.

After surgical intervention for FAI, the focus shifts to rehabilitation to facilitate a timely return to sport (RTS) and ensure optimal outcomes for athletes. Numerous protocols have been described in the literature for postoperative rehabilitation following hip arthroscopy (for review see [6]). Recent guidelines introduced in 2019 by the International Society of Hip Preservation (ISHA) have included a RTS timeframe of at least 5 months after surgery [7]. In a group of professional hockey players, Philippon *et al.* reported that the average time to return to skating was 3.8 months (range 1–5 months) [8]. However, time to return to previous level of competition was not reported. Conversely, in a mixed population of high-level athletes Nho *et al.* reported that 79% of patients were able to return to play after hip arthroscopy at a mean of 9.4 ± 4.7 months (range 4–26 months) [9]. Similarly, Levy *et al.* described that 94% of high-level athletes returned to running at a mean of 8.5 ± 4.2 months [10]. A systematic review with meta-analysis, which included athletes across a wide age range and athletic competition levels (professional, college, high school, or middle school, amateur/recreational), found that the mean time from surgery to RTS was 7.0 ± 2.6 months [11]. A recent systematic review reported a slightly longer time to RTS 8.0 ± 3.3 months with 14.3 ± 9.6 months to return to previous or higher level of performance [12].

In addition to variability in the timing of RTS, the literature underscores significant variability in the rate of RTS after hip arthroscopy for FAI. For instance, O'Connor *et al.* reported that

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the proportion of professional athletes who were able to RTS ranged from 82.0% to 93.3% [13], while the proportion of recreational athletes who returned to sport ranged from 66.7% to 84.0% [14–16]. Notably, Weber *et al.* demonstrated in NCAA Division I athletes that the rate of RTS varied significantly between different sports, emphasizing the impact of exercise type on RTS [17]. While RTS rates remain a key metric in evaluating the success of hip arthroscopy for FAI, it is imperative to recognize that high RTS rates may not always correlate with satisfactory patient-reported outcomes.

A considerable percentage of patients report suboptimal outcomes after hip arthroscopy for FAI: less than half of patients (46.7%) reported an acceptable symptom state using the Copenhagen Hip and Groin Outcome Score (HAGOS) and the International Hip Outcome Tool-33 (iHOT-33) 12 to 24 months after surgery [18]; 65% of patients reported an acceptable symptom state using the modified Harris Hip Score (mHSS) 12 months after surgery for FAI [19]. Therefore, it is important to examine patient-reported outcomes and time of RTS when assessing the efficacy of hip arthroscopy for FAI. The present study aimed to investigate the timeline for RTS using the 2019 rehabilitation guidelines introduced by ISHA [7] with some modifications (see Appendix A). It was hypothesized that most athletes RTS within 5 months postoperative without any adverse effects.

MATERIALS AND METHODS

Patients with FAI who underwent hip arthroscopy under the primary author's care were identified. Surgery was performed in the supine position with post-less distraction in all cases. An inter-portal capsulotomy was performed, and central compartment work (including labral, chondral, and acetabular procedures) was completed. Traction was released and the suction seal of the labrum was assessed. The hip was then flexed and femoral osteochondroplasty was completed as necessary. The capsulotomy was then closed. While all patients followed the ISHA RTS guidelines [7], with additional recommendations (see Appendix A), rehabilitation ultimately varied based on the patient's sport and level of competition. Typically, patients had physical therapy two or three times per week starting within a week of surgery and continuing to approximately 3 months after surgery. The accelerated components of the rehabilitation were: (I) weight-bearing as tolerated with full weight-bearing without assisted devices encouraged in the first few days after surgery and required by 10 days postoperative; (II) stationary bike from Day 1 postoperative; (iii) deep hip rotator stabilization exercises at Week 4; (IV) standing trunk rotation exercises including golf swing, if relevant, in the 4–8 week range; (V) running program initiated at Week 8; (5) high-demand sports-specific agility exercises in the 12–16 week range.

The preoperative diagnosis was based on the presence of hip pain and radiographic evidence of FAI (cam FAI, pincer FAI, or mixed FAI) as evidenced in the radiology report. Participants were contacted only if they met the following inclusion criteria: individuals aged between 18 and 60 years with unilateral or bilateral FAI who underwent a hip arthroscopic labral repair and were actively engaged in sports, either recreationally or competitively. Exclusion criteria comprised patients with a prior revision, labral reconstruction, trochanteric space surgery (bursectomy, abductor repair), and those with greater than Tonnis Grade I osteoarthritis of the hip joint. Institutional review board approval was obtained prior to study initiation and patients consented to participate prior to the commencement of postoperative data collection.

At the point of follow up, participants were emailed a REDCap link to a demographics survey, the Modified Harris Hip Score (mHHS) and the Copenhagen HAGOS. The study was approved by institutional review board and patients provided informed consent through the electronic link. Patient Acceptable Symptom State (PASS) for the mHSS as reported by Chahal *et al.* was recorded as mHHS >84 [19]. The demographics survey collected information about participant gender, age at date of surgery, age at follow up, information about the side of injury, symptom duration, activity level, complications, and revision surgeries. Specifically, the following questions were asked about participant activity levels and symptoms: (I) Prior to your hip surgery for how long did you have symptoms? (II) Prior to your hip injury were you regularly playing competitive sports? (III) At what level did you play competitive sports prior to your injury? (IV) Prior to your hip injury were you regularly playing recreational sports? (V) What sporting activities did you intend to return to after your hip surgery? (vi) Did you return to your intended sporting activity after the surgery? (VII) Did you return to your previous level of competition after the surgery? (VIII) How many months after surgery did you return to your intended sport? (IX) How many months after surgery did you return to your intended level of competition? and (x) Have you had any symptoms in your hip since returning to sport? Patients who had bilateral surgery completed all surveys based off the time since their second surgery.

Participants were defined as being active in (I) exclusively recreational sports, and/or (II) competitive sports. Competitive sport was defined as a sport in which the participants had regular practice or training sessions in addition to games, while recreational sports were defined as any sport or physical activity without regular practices or training sessions [20]. Competitive sports were further categorized as high-demand versus moderate-demand based on the level of play (professional, college, elite nonprofessional), the demand of the sport, and the volume of play and practice required to participate at their level of play. This yielded three groups: low-demand recreational athletes, moderate-demand competitive athletes, and high-demand competitive athletes.

Clinical data were analyzed by using the JASP graphical software package [Version: JASP 0.17.1 (Intel)]. Data are presented as means and standard deviations or percentages where appropriate. Age, duration of symptoms, time from surgery to follow-up, and time to RTS were compared between levels of sports participation using one-way analysis of variance (ANOVA). Proportions of athletes returning to sport successfully from each group were compared using the chi-squared linear. Additionally, time to RTS was compared between groups using log-rank survival analysis. Independent *t* tests were used to compare mHHS and HAGOS between athletes with early return to sport(<5 months)

and late RTS (>5 months). Proportions of patients achieving a PASS score for mHSS were compared between early and late RTS using the chi-squared analyses. Data are reported as mean ± SD and an alpha of 0.05 was set a priori.

RESULTS

A total of 56 patients (22 males, 34 females) consented to participate in the study, at an average follow-up period of 26 ± 10 (range: 10–47) months after surgery. Prior to surgery, patients had experienced symptoms for 1.7 ± 1.4 (range: 6 months–4.5 years). The mean age at the time of surgery was 36 ± 14 years old. For the five patients who had bilateral operations the mean time between the two surgeries was 19 ± 14 days. As per the inclusion criteria all 56 patients had a labral repair, with 38% having removal of loose bodies. No microfracture procedures, ligamentum teres debridement, or decompressions were performed. Almost all patients had combined cam and pincer lesions (three pincer only).

The mean time to RTS was 5.3 ± 3.5 months postoperatively (Table 1). Age ($P = .913$), symptom duration ($P = .526$), and time to RTS ($P = .425$) did not differ between male and female patients.

There were 35 low-demand recreational athletes, 11 moderate-demand competitive athletes, and 10 high-demand competitive athletes. The high-demand athletes comprised two ice hockey players (one junior, one college), three soccer players (one college, two post college high-level club players), two golfers (one college, one high level amateur), one semi-professional dancer, one college field hockey player, and one elite sabre fencer. The high- and moderate-demand competitive-level athletes were younger than the low-demand recreational athletes, but there were no differences between groups for duration of symptoms prior to surgery, time from surgery to follow-up, proportion of athletes returning to sport, or the time to RTS (Table 1). A total of 44 patients returned to sport (79%, Table 1). All 10 high-demand competitive athletes had returned to sport by 12 months compared with 9 of 11 moderate-demand competitive athletes and 24 of 35 low-demand recreational athletes (Fig. 1). All 19 competitive level athletes returned to their previous level of competition. Of the five patients with bilateral surgeries, one was a high-demand competitive athlete, two were moderate-demand competitive athletes, and two were low-demand recreational athletes. All five returned to sport at their previous level of play.

Time to return to previous level of competition was 9.4 ± 7.8 mo for high-demand competitive athletes, 6.1 ± 2.1 for moderate-demand competitive athletes, and 8.1 ± 7.0 mo for low-demand recreational athletes ($P = .554$).

While the athletes returned to sport at an average of 5.3 ± 3.5 months, 25 (45%) had returned within 5 months and 43 (77%) had returned by 12 months (Fig. 1). One athlete returned to sport by 20 months. Of the 12 patients who did not RTS, 7 had continued symptoms (of which one went on to revision surgery, one hernia surgery, one received sacroiliac joint injection), four had an unrelated injury that prevented them from returning to sport, and one did not RTS for reasons unrelated to their hip or other injury. These 12 athletes who did not RTS were not different in age from those that did return (40 ± 14 versus 35 ± 14 years old, $P = .344$).

HAGOS score was 79.0 ± 20.6, while average mHHS was 88.1 ± 14.6 for all patients. HAGOS was significantly better for the individuals who returned to sport (81.6 ± 19.0) versus those who did not (66.6 ± 25.2; $P = .014$). There was no difference in mHHS in those who returned to sport (89.5 ± 14.5) compared to those who did not (82.0 ± 14.2; $P = .071$). Nevertheless, 91% of the individuals who returned to sport exceeded the PASS for the mHSS, while only 58% of those who did not RTS met the PASS threshold ($P = .003$). Neither HAGOS nor mHHS outcomes differed in the athletes who RTS in ≤ 5 months versus those who took longer to RTS (Table 2). Both HAGOS and mHSS were significantly better in individuals who returned to sport and reported no symptoms at follow-up (HAGOS: 94.0 ± 7.0, mHHS: 98.5 ± 2.1), compared to those continuing to experience symptoms HAGOS: 75.8 ± 20.1, mHHS: 85.3 ± 15.9; $P < .001$).

The average duration of symptoms prior to surgery was 1.7 ± 1.4 years for the 56 patients. This duration was not different between the 44 participants who ultimately returned to sport (1.7 ± 1.4 years) and the 12 who did not (1.8 ± 1.4 years, $P = .745$). Additionally, there were no differences in duration of symptoms prior to surgery between low-demand recreational athletes (1.6 ± 1.4 years), moderate-demand competitive athletes (1.7 ± 1.5 years), and high-demand competitive athletes (2.1 ± 1.4 years, ANOVA $P = .637$).

Of the 44 patients who returned to sport, 14 reported being symptom free while playing their sport, 12 had symptoms that did not limit sports participation, 14 had symptoms that somewhat limited sports participation, and 4 had symptoms that caused their sports participation to be very limited.

Table 1. Participant demographics based on activity level

	N	Age at time of study (years)	Time surgery to follow-up (months)	Symptom duration (years)	RTS # (%)	Time to RTS (months)
High-demand competitive (HD)	10	22 ± 8	30 ± 12	2.1 ± 1.4	10 (100%)	4.9 ± 3.4
Moderate-demand competitive (MD)	11	29 ± 13	27 ± 12	1.7 ± 1.5	9 (82%)	5.1 ± 1.7
Low-demand recreational (LD)	35	42 ± 12	24 ± 9	1.6 ± 1.4	25 (71%)	5.6 ± 4.1
ANOVA *P*-value pairwise differences		$P < .001$ HD&MD < LD	$P = .218$	$P = .637$	$P = .054$	$P = .870$

Mean ± standard deviation.

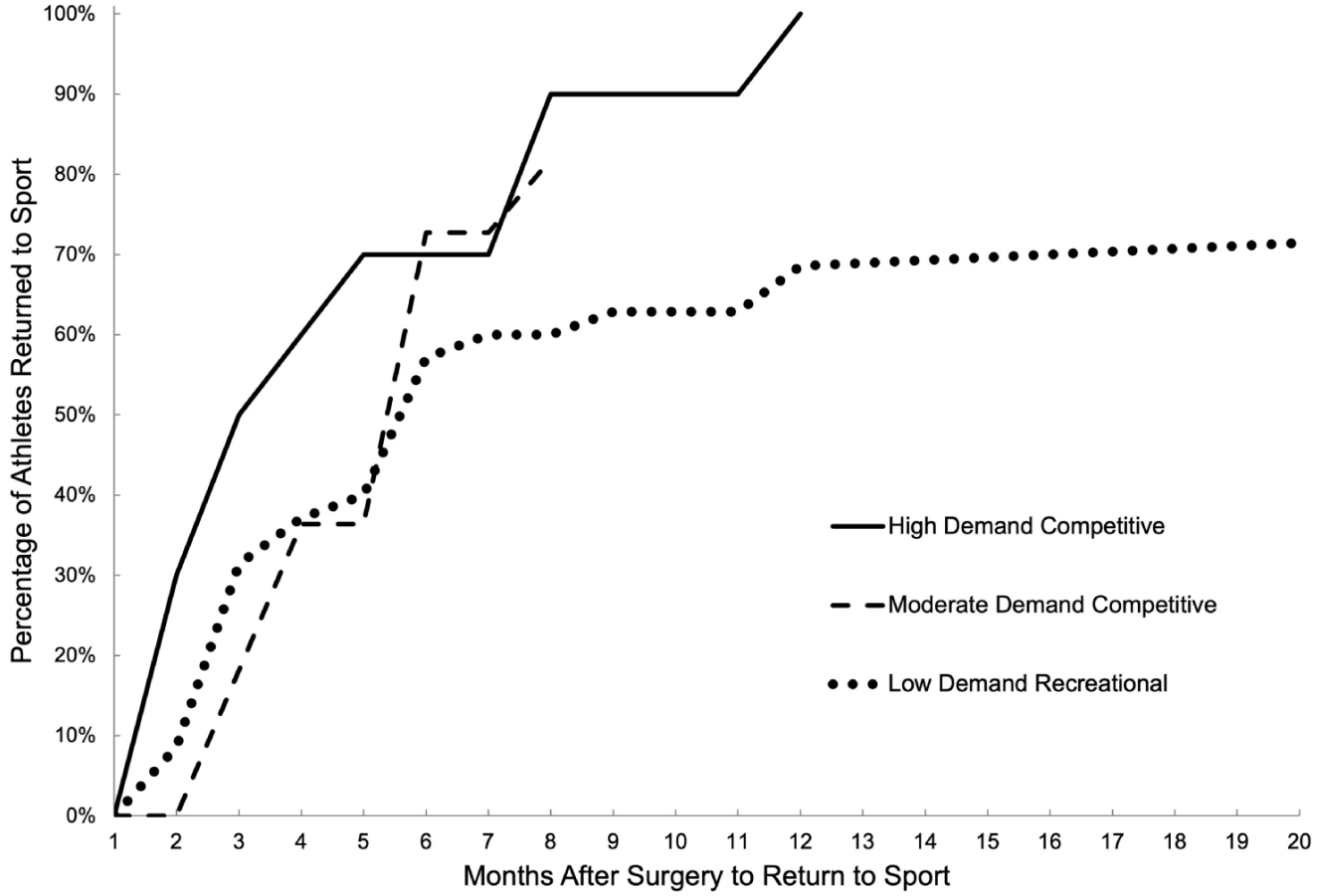

Figure 1. Survival analysis log rank test of equality of time to RTS by level of sports participation ($P = .063$), with RTS better for high-demand competitive athletes compared with low-demand recreational athletes ($P = .022$).

Table 2. mHHS and Copenhagen HAGOS for early RTS ($\leq$5 months) and late RTS (>6 months) All data presented as mean $\pm$ standard deviation.

	Time to follow-up (months)	HAGOS	mHSS
RTS $\leq$ 5 months	23.0 $\pm$ 11.3	80.4 $\pm$ 22.3	88.0 $\pm$ 17.7
RTS > 6 months	28.3 $\pm$ 10.8	84.6 $\pm$ 11.8	91.5 $\pm$ 8.7
	$P = .217$	$P = .458$	$P = .424$

The prevalence of symptoms upon RTS was not different between high-demand competitive athletes, moderate-demand competitive athletes, and low-demand recreational athletes ($P = .852$).

DISCUSSION

The results of the present study indicate that a majority of patients who have undergone hip arthroscopy for FAI RTS in a timeframe shorter than previously suggested (within 5.3 $\pm$ 3.5 months versus 7.0 $\pm$ 2.6 as reported by Reiman *et al.* [11]). Notably, earlier RTS did not result in an exacerbation of symptoms. Therefore, this study supports the notion that an accelerated RTS, defined as within 5 months postoperative, can be safely achieved following hip arthroscopy for FAI.

Successful recovery after hip arthroscopy for FAI involves rigorous postoperative physical therapy, especially in athletic patients, in order to return to previous sport levels [21]. Historically, there was a lack of high-level evidence to guide postoperative rehabilitation after hip arthroscopy for FAI, with most postoperative protocols being organized in 4–5 phases based on the work of Garrison *et al.* [22]. More recently, ISHA updated these guidelines and introduced an accelerated RTS rate, suggesting a timeline of 5 months after surgery [7]. These guidelines were necessary after considerable variability in rehabilitation protocols was previously identified in the ISHA surgeon database [23]. While all of the participants in the present study followed the structured, yet individualized, ISHA guidelines, there remained substantial variability in the RTS timeline in the patient population ranging from 2 to 20 months. Notably, the individual who returned to sport in 20 months was a competitive karate athlete who was unable to ultimately return to their previous level of competition. All other participants returned to sport within 12 months. This highlights the complexity of rehabilitation post-FAI surgery and underscores the importance of tailoring treatment plans to the unique needs and demands of each patient, particularly athletes aiming to return to high-level competition.

In their systematic review with meta-analysis, Reiman *et al.* [11] reported an average time of 7.0 ± 2.6 months, with the caveat that 25% of patients did not return to their preinjury level of competition. In the present study, the high-demand competitive athletes returned to sport in 4.9 ± 3.3 months and it took them 9.4 ± 7.8 months to reach their previous level of competition. All 10 high-demand athletes returned to their sport. These athletes were younger than the low-demand recreational athletes (22 ± 8 versus 42 ± 12 years). This is in agreement with previous studies showing that athletes under 25 years old are not only more likely to return faster to their respective sport but also return at higher rates [24]. Similarly, Abrahamson *et al.* [25] found that younger athletes had higher rate of RTS compared to their older counterparts. This trend underscores the importance of considering age as a significant factor in the rehabilitation process for athletes undergoing surgery for FAI.

The results of the present study also indicate that arthroscopic treatment of FAI, in combination with accelerated RTS, results in significant improvement in hip functional outcomes as demonstrated by better HAGOS outcomes ($P = .014$) and PASS rate for mHSS ($P = .003$) in those individuals who returned to sport versus those who did not. This finding is in line with those of Abrahamson *et al.* [25] who similarly demonstrated that athletes who ultimately returned to sport had greater improvements in HAGOS than those who did not return. Interestingly, the results of the present study showed that asymptomatic individuals who successfully returned to sport demonstrated higher HAGOS outcomes than those who continued to experience symptoms. Nevertheless, despite a majority of athletes still experiencing ongoing symptoms upon their RTS, this did not hinder their sports participation. These findings are in line with the results of previous research which found that half of subelite athletes encounter hip and groin pain during a season [26]. Among them, those with the longest duration of pain exhibited the lowest HAGOS scores at the onset of the new season. These findings also align with the earlier work of Thorborg *et al.* [27], which highlighted that soccer players with hip and groin pain exhibited lower HAGOS scores compared to their pain-free counterparts. Collectively, these results underscore the resilience of athletes, emphasizing their ability to maintain sports participation even in the face of persistent symptoms. This conclusion is further supported by The Warwick Agreement on FAI syndrome [28], which suggests that athletes with persistent symptoms may maintain sports participation with conservative care, rehabilitation, and arthroscopic or open surgery.

While the present study provides valuable insights, it was not without limitations. First, the time to RTS was a subjective recollection for the participants, which may not have accurately reflected the passage of time. Secondly, the present study's small sample size may limit generalizability. For example, given the variability in time to return to previous level of competition for high-demand competitive athletes (9.4 ± 7.8 months) and low-demand recreational athletes (8.1 ± 7.0 months), there was insufficient power to detect a practically meaningful difference. Additionally, the study's retrospective nature introduces potential biases and confounding factors that could affect the interpretation of results. Furthermore, the absence of a control group (nonoperative treatment) limits the ability to draw definitive conclusions about the efficacy of RTS rates for FAI. Future research utilizing the ISHA rehabilitation guidelines [7], with larger sample sizes and prospective study designs, would provide a more comprehensive understanding of the optimal rehabilitation strategies for athletes undergoing surgery for FAI. Studying a more homogeneous population with respect to sport and age would provide more applicable clinical information. Lastly, while the outcomes were generally positive for this patient sample, the validity of the mHSS has been questioned [29]. The HAGOS may be a better outcome score for this condition.

In summary, the findings of the present study support the ISHA guidelines [7], and challenge previous timelines regarding RTS following hip arthroscopy for FAI. The results suggest that a considerable number of patients RTS in less than the traditionally recommended recovery time, with no negative impact of rate of RTS on Patient Reported Outcome Measures (PROMs). These findings contribute to the evolving body of knowledge on hip arthroscopy outcomes, emphasizing the need for tailored rehabilitation strategies and individualized approaches to support athletes in their journey back to sport and, or competition following surgical interventions for FAI.

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CONFLICT OF INTEREST

No conflict of interest.

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DATA AVAILABILITY

The data underlying this article will be shared upon reasonable request to the corresponding author.

APPENDIX A: ACCELERATED REHABILITATION PROTOCOL

Guidelines
RTS Following Hip Arthroscopy for Femoroacetabular Impingement Syndrome
0–2 Weeks

- Initiate stationary bike on postoperative Day 1 as tolerated.
- Prioritize gait training WBAT with or without assistive device.
    - o Increase weight-bearing while maintain normal gait.
    - o Wean off crutches ($2 \gg 1 \gg 0$) once gait is normalized.
        - Full weight-bearing without assistive device by at least 10 days.
- Limit hip external rotation (ER) to 20° for 2 weeks.
- Hip abduction, adduction, extension, ER PROM as tolerated.
    1) Stool rotations/prone rotations.
    2) Hip isometrics (no flexion/no straight leg raises).
    3) Pelvic tilt.

4) Supine hip bridge.
5) Scar massage.
6) Supine hip log rolling for internal rotation (IR)/external rotation (ER).

2–4 Weeks

- No hip hyperextension.
- Stool/prone rotations for ER >20°.
- Bent knee fall outs (Week 4).
- Isometric sub max pain free hip flexion.
- Introduce core exercise.
- Step downs.
- Isometric side-lying hip abduction (clam shells).
- Hip hiking (Week 4).
- Proprioception/balance training (bilateral).
- Bilateral cable column trunk rotations.

4–8 Weeks

- Transition from bike to elliptical.
- ROM.

1) Standing BAPS rotations.
2) Prone hip rotation ER/IR.
3) External rotation with FABER.
4) Hip joint mobs with mobilization belt into limited joint ROM (if necessary).
5) Proprioception/balance training (foam).

4–8 Weeks (continued)

- Strength.

1) Initiate deep hip rotator stabilization program (Week 4).
2) Hip flexion isotonics leg press (unilateral).
3) Side stepping (theraband, incline treadmill).
4) Isokinetics: knee flexion/extension.
5) Stiff leg deadlifts.
6) Prone/side planks.
7) Transition cable column rotations to unilateral.
8) Add golf swing if applicable.

8–12 Weeks

- Initiate treadmill running.
- Progress ROM and strengthening.
- Progress to interval running.
- Introduce plyometrics.
- Initiate slide board progressing to skating if applicable.

12–16 Weeks

- RTSs specific cutting and pivoting if applicable to patient's sport.
- Progress:

1) ROM.
2) Strengthening.
3) Lower extremity
4) Core.
5) Hip endurance

- Introduce:

1) Higher demand sport specific agility drills.

Criteria for discharge/return to play (sport or competition)

- Hip strength within 10% of uninvolved side.
- Isokinetic test of quadriceps and hamstrings peak torque within 15% of uninvolved.
- Single hop for distance at least 85% of noninvolved if applicable to patient's sport.

Step down test equal to noninvolved (unilateral squat).

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